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Matlab-Based Portable Driver Monitoring System

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Abstract: *Numerous studies indicate that one of the primary causes of traffic accidents is tiredness among drivers. One of the biggest challenges in the area of accident avoidance is the development of technologies that prevent sleepiness at the moment. The development of intelligent vehicle systems has been made possible by advancements in computer technology. The goal of this research is to identify driver sleepiness in order to reduce accidents and increase highway safety. A system that uses video analysis to identify driver weariness or sleepiness is being presented. To find the driver's facial area, a real-time face detection system is used. A camera that aims straight at the face and records footage is used to create a technique for identifying driver tiredness. The system analyzes video camera pictures of the driver's face using image processing technology as a detecting approach. The video has been recorded, transformed into a number of picture frames, and the eyes and facial area are monitored to identify signs of tiredness. The device can keep an eye on the eyes and detect whether they are open or exhibiting symptoms of sleepiness. By using a noncontact method of assessing different degrees of attention, this detection system enables early identification of a drop in alertness while driving.*

Keywords: *MATLAB, Image Segmentation, Intelligent Vehicle, Monitoring System*

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I. Introduction

One of the main objectives of Intelligent Transportation Systems (ITS) is to increase public safety and decrease accidents. Driver weariness and monotony are two of the most significant contributing causes to accidents, particularly on rural roads. Driver perceptions and decision-making skills are diminished by fatigue. According to research, a motorist often feels exhausted after one hour of driving. Driver weariness and sleepiness are much higher in the afternoon, early in the morning, after lunch, and at midnight than they are at other times. Loss of consciousness may also result from drug addiction, alcohol use, and the use of hypnotic medications. Different data about accidents caused by driver weariness and distraction have been recorded in various countries. Driver fatigue and inattention are often the primary causes of 20% of collisions and 30% of fatal collisions. Up to 50% of collisions involving big vehicles or single-vehicle wrecks (accidents in which only one vehicle is damaged) are caused by drivers who are not paying enough attention. Current research indicates that the use of driver face monitoring devices is projected to lower the number of accidents by 10% to 20%. A real-time system that analyzes driver face photos to determine the driver's physical and mental health is called a driver face monitoring system. Eye closure, eyelid distance, blinking, gaze direction, yawning, and head rotation may all be used to determine the driver's condition. In hypovigilance situations, such as weariness and distraction, this mechanism will sound an alert. The three main components of the driver face monitoring system are the intelligent software, hardware platform, and imaging. A driver monitoring system consists of the following primary components: Face identification, eye detection, face tracking, symptom extraction, and driving state assessment are the first five steps. Face detection is the first step in image processing in the majority of driver face monitoring systems. There are two broad types of face detection techniques: (1) feature-based techniques and (2) learning-based techniques. The idea behind feature-based approaches is that by using heuristic rules on characteristics, the face in the picture may be identified. These techniques are often used to identify a single face in a picture. One of the popular and quick techniques is color-based facial recognition. With these techniques, the face is identified by its form and skin tone. It is possible to use color-based face recognition on several color spaces, such as RGB, YCbCr, or HIS. These algorithms perform poorly in photos with low light or noise levels. Learning-based face detection learns the discriminative features using training samples and statistical learning techniques. These techniques come from machine learning algorithms and statistical models. For face identification, learning-based approaches often have lower error rates, but they also typically need greater computing power. An very quick and reliable object identification technique was reported by Viola and Jones. Face detection made use of this method. Due to the significance of eye-related symptoms, the eye area is always analyzed in order to extract the symptoms in almost all driver face monitoring systems. Therefore, eye recognition is necessary prior to processing the eye area. This study proposes a novel driver face monitoring system that adaptively extracts hypovigilance signs from the driver's face and eyes. A fuzzy expert system then analyzes the symptoms to identify the driving condition.

II. System Overview

The hardware and software components used in this project are covered in this chapter. Below is a list of the hardware parts. This project is using the block diagram that is seen below.

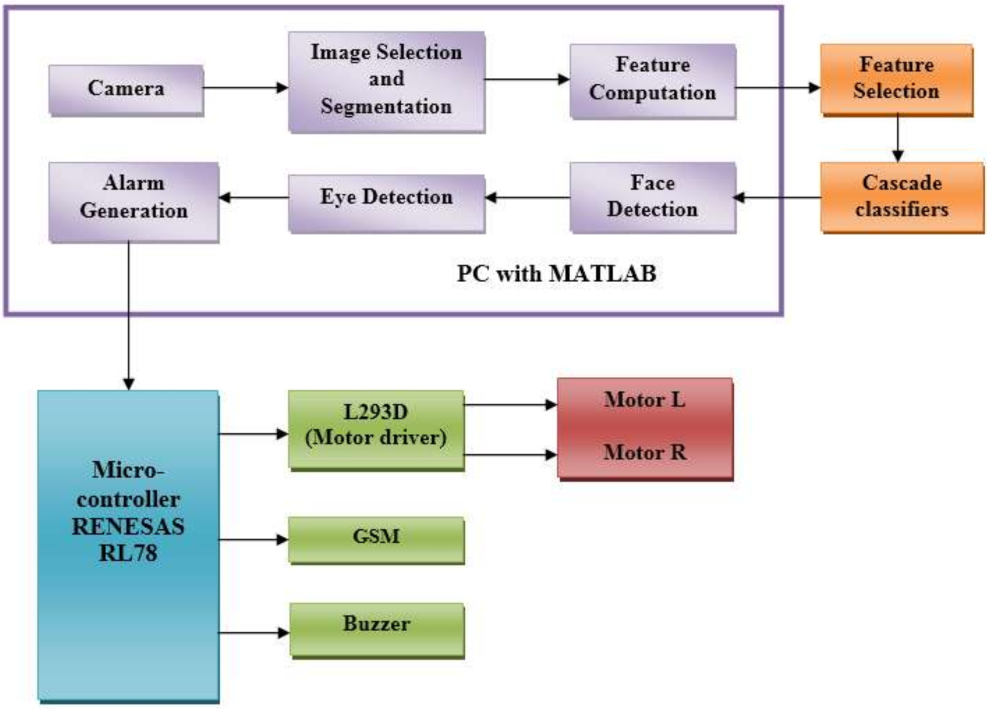


Fig 2.1: Proposed system block diagram

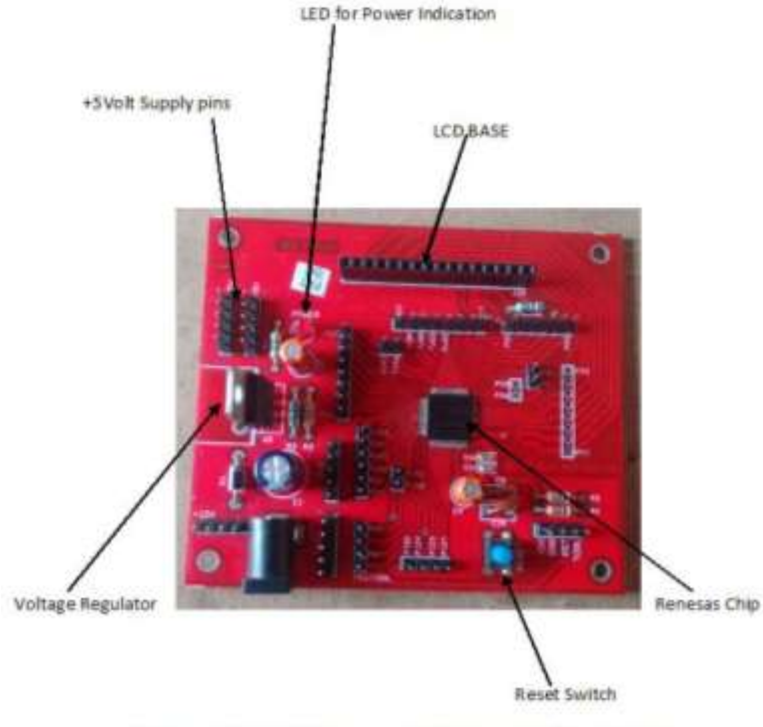
The following sub-modules must be chosen, researched, analyzed, designed, and tested in order to create the full functional driver monitoring system. Obtaining Images: To continually record the driver, a video camera equipped with a series of infrared LEDs is positioned in front of the driver. Face Detection: To better monitor the driver, a powerful face detection module identifies the area of their face. The Viola-Jones face detection technique serves as the foundation for the face detection algorithm. Eyes Detection: A HAAR Classifier-based eyes detection module is used to find the driver's eye coordinates. It is the primary block for identifying eye distraction. It contrasts the outcomes with the typical eye condition needed for safe driving. Visual Cues Extraction: Additional visual cues of the driver's face, such as the movement of the eyelids, face alignment, and gaze direction, are recovered using the face and eye coordinates. Visual Cues Tracking: Frame by frame, the retrieved visual cues' positions and motions are monitored. The driver's state is created by fusing the visual data from several visual signals. Driver Vigilance Level Decision: The driver's alertness or vigilance level is decided based on their status as assessed in earlier blocks, and if their alertness is very low, an alarm is triggered. Continuous monitoring is carried out if the circumstances are normal. The data is then sent to the microcontroller, which uses GSM to send the driver an SMS and alerts them when they are becoming sleepy.

2.1 Renesas microcontroller:

By providing system designers with superior power-saving capabilities and high-performance operation, these increasingly common MCUs enable ultralow-power applications. RL78 MCUs are undeniably better options for a wide range of battery-powered applications because they include crucial features including an inventive Snooze mode that permits serial connection and ADC functioning when the CPU is not in use.

Best-in-class performance due to reduced power consumption and excellent designs.
Package, memory, and peripheral feature scalability.
Cost-saving characteristics of the system.
Operation at a wide voltage and temperature.
Features for on-chip safety.

The Renesas controller group is perfect for a variety of consumer and industrial applications, including motor control and sensor systems, that call for high-performance timer and analog capabilities in tiny packages.



2.2 L293 Motor Driver

Two tiny motors may be controlled simultaneously and in both directions using the L293 integrated circuit motor driver.

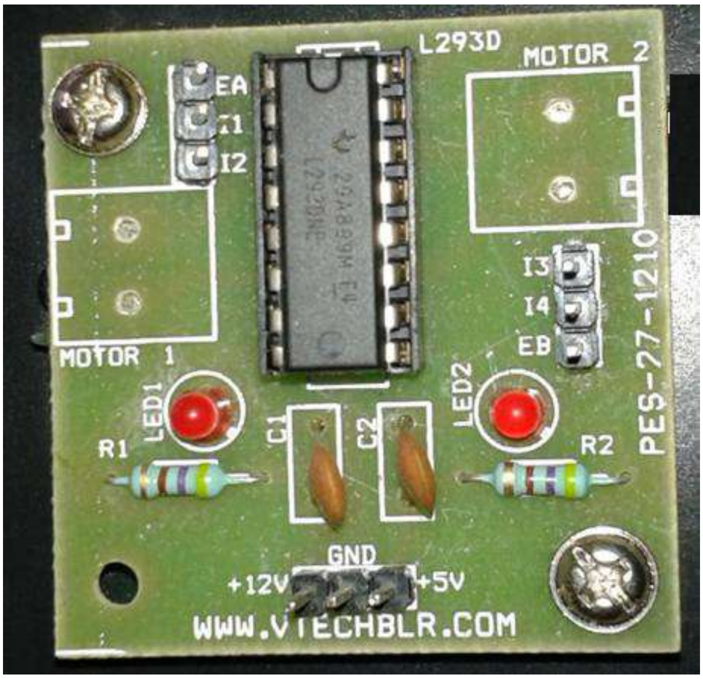


Fig 2.2: L293D Motor driver

The device is a four-channel, monolithic integrated high voltage, high current driver that can drive switching power transistors and inductive loads including relays, solenoids, DC motors, and stepper motors. It can also take normal DTL or TTL logic levels. Each pair of channels has an enabled input to make it easier to utilize as two bridges. Internal clamp diodes are present, and the logic has a separate supply input that enables operation at a lower voltage. At frequencies up to 5 KHz, this device may be used in switching applications.
The L293D is put together in a 16-lead plastic box with four center pins that are linked and serve as heat sinks. Since the L293D is an integrated circuit motor driver, two tiny motors may be controlled in both directions at the same time. L293D has a 600 mA limit.

2.3 GSM

The Global System for Mobile Communications is referred to as GSM. In order to characterize technology for second generation (or "2G") digital cellular networks, the European Telecommunications Standards Institute (ETSI) created this collection of standards. In order to replace first-generation analog cellular networks, the GSM standard was first used to specify switched circuit networks for full duplex voice communication.

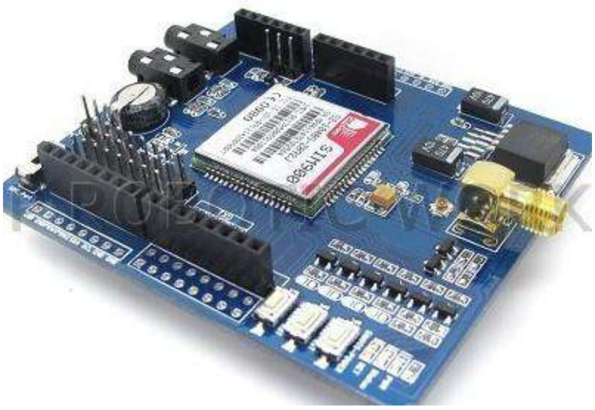


Fig 2.3: GSM Module

Most 2G GSM networks use the 900 MHz or 1800 MHz bands, however GSM networks use a variety of carrier frequency ranges (divided into GSM frequency ranges for 2G and UMTS frequency bands for 3G). The 850 MHz and 1900 MHz bands were used in places where these channels were previously allotted (such as in the US and Canada). Because the 400 and 450 MHz frequency bands were formerly used for first-generation systems, they are sometimes allotted in certain nations.

2.4 Buzzer

Fig 2.4 buzzer module

Buzzers are audible signaling devices that are often used for timers, alerts, and verifying user input, such as a keyboard or mouse click.
The microcontroller warns the user with a buzzer sound when it senses an LPG gas leak.
Operating Current: 40mA, Operating Voltage: 5V DC

III. Methodology

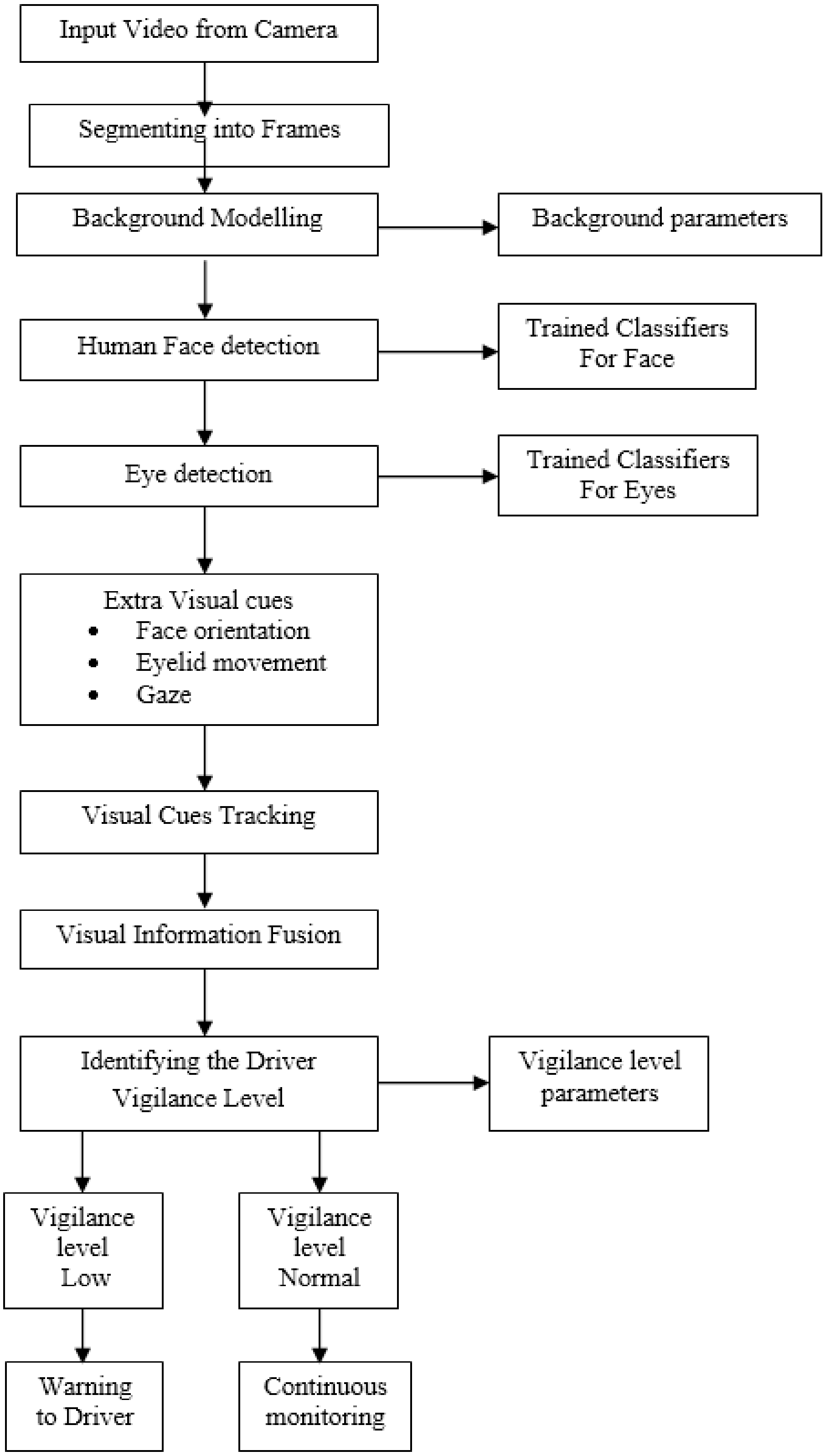


Fig 3 Flow diagram of Methodology

IV. Results & Discussion

Fig 4.1: Human detection

MATLAB has been used to construct the whole functioning prototype module of the driver monitoring system and evaluate its performance and usefulness. Before the whole system is put together, each individual module is examined, evaluated, and tested. According to figure 4.1, the functioning module looks like this.

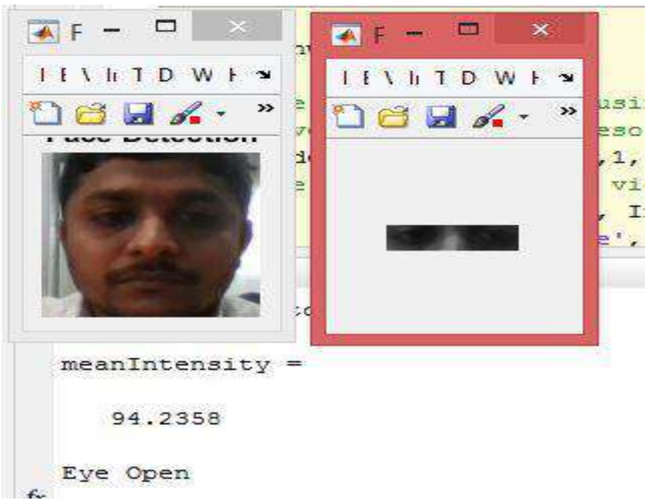


Fig 4.2: recognition of face

One frame out of every frame is shown graphically here. The intensity increases while the eyes are open and decreases when they are closed. Additionally, its intensity peaks between two places. We reiterate these two points. The eyes will be open between these two positions, according to the analysis of every picture of the ocular area alone.

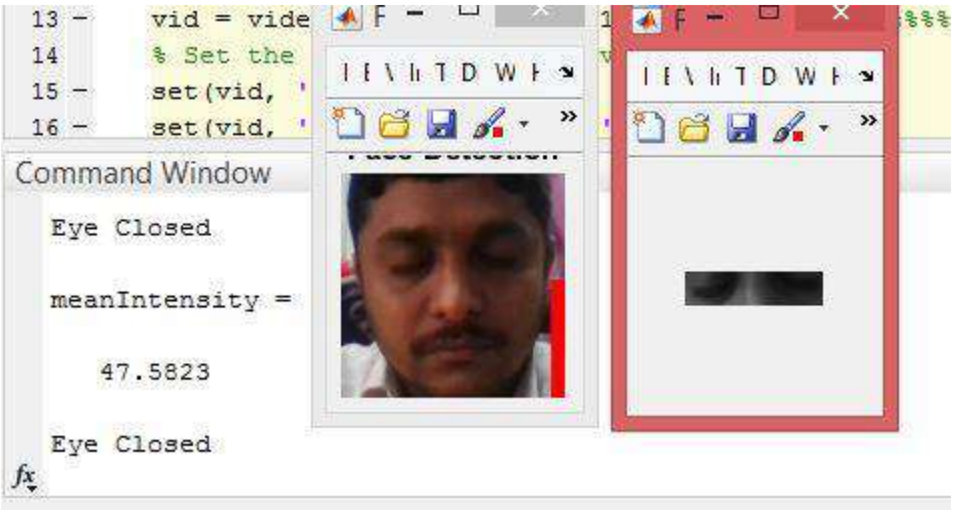


Fig 4.3 Resulted image of drowsiness

This indicates that the driver is feeling sleepy, which is why the intensity is different from the prior record. Different self-developed image processing algorithms are used to collect information about the location of the face and eye. The device can determine if the eyes are open or closed throughout this operation.

Fig 4.4: Displaying person's state as drowsiness

As can be seen in picture 4.4, this particular interface is indicating that the driver is experiencing drowsiness.

V. Conclusions

With the successful execution of the work that was presented, this study was able to accomplish its primary purpose, which was to create a Driver monitoring system that was dependable, inexpensive in cost, and low in power consumption. This technique demonstrates that facial expressions are very dependable markers of a driver's state of tiredness, and that facial expressions may be used to perform fine discriminating in a variety of drowsiness levels. In this context, it entails the use of highly developed image processing algorithms to identify the facial expressions of drivers, which in turn reduces the amount of hardware that is required. Additionally, it determines with a high degree of accuracy if the eyes are open or closed, as well as the intensity values.

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